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LIFE AND MICROGRAVITY
SCIENCES AND
APPLICATIONS
[OLMSA]

HEDS
ENTERPRISE

International Space Station as a Testbed for Exploration

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Agency & Enterprise Goals

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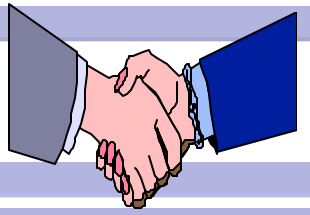
Agency Mission

- Advance & communicate scientific knowledge & understanding of the Earth, the solar system, & the universe & use the environment of space for research
- Explore, use, & enable the development of space for human enterprise
- Research, develop, verify, & transfer advanced aeronautics, space, & related technologies

HEDS Goals

- long term: Expand the frontier
- long term: Expand knowledge
- *near term*: Enable and establish permanent and productive human presence in Earth orbit
- long term: Expand commercial utilization of space
- long term: Share the experience and discovery of human space flight



The Multipurpose ISS

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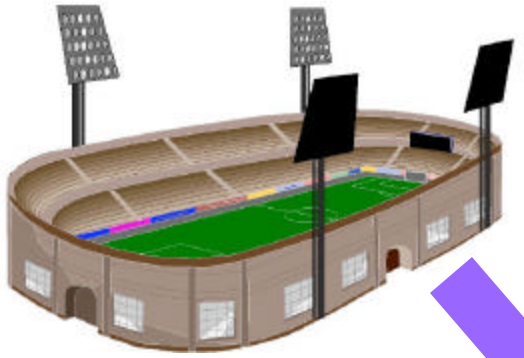

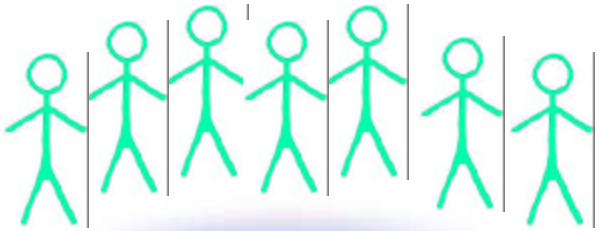

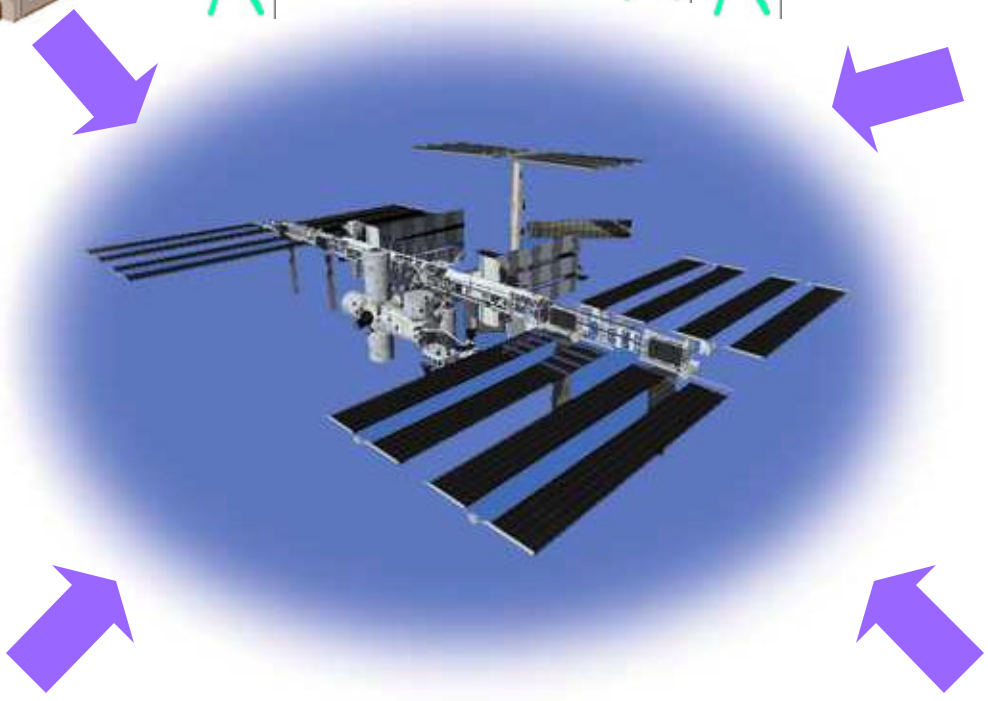

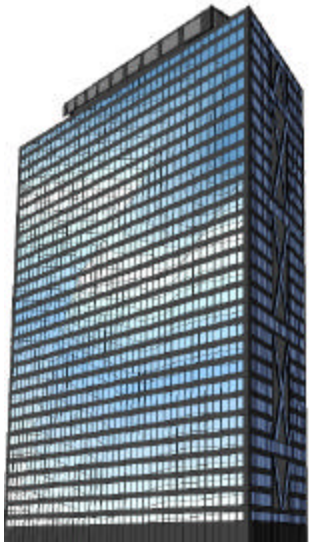

Human Space Mission Architecture

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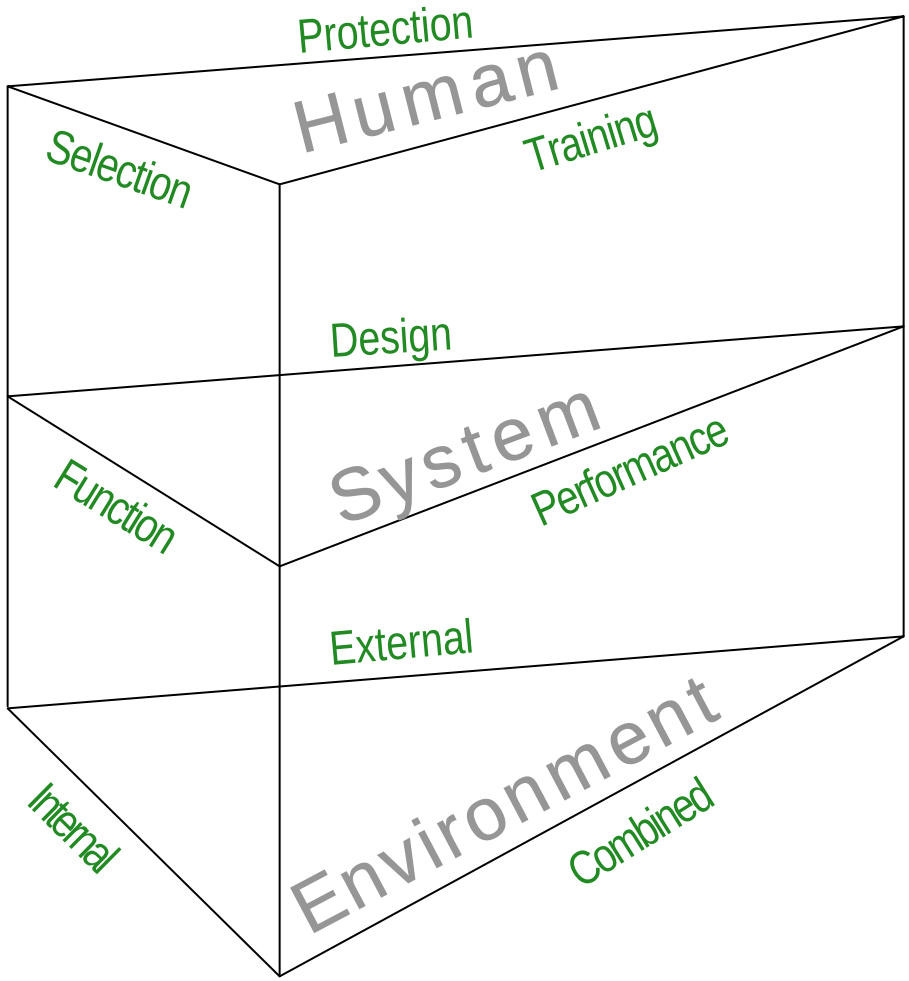

Designers must facilitate Human performance by creating…

…a System that responds effectively to…

Environment

External Environment

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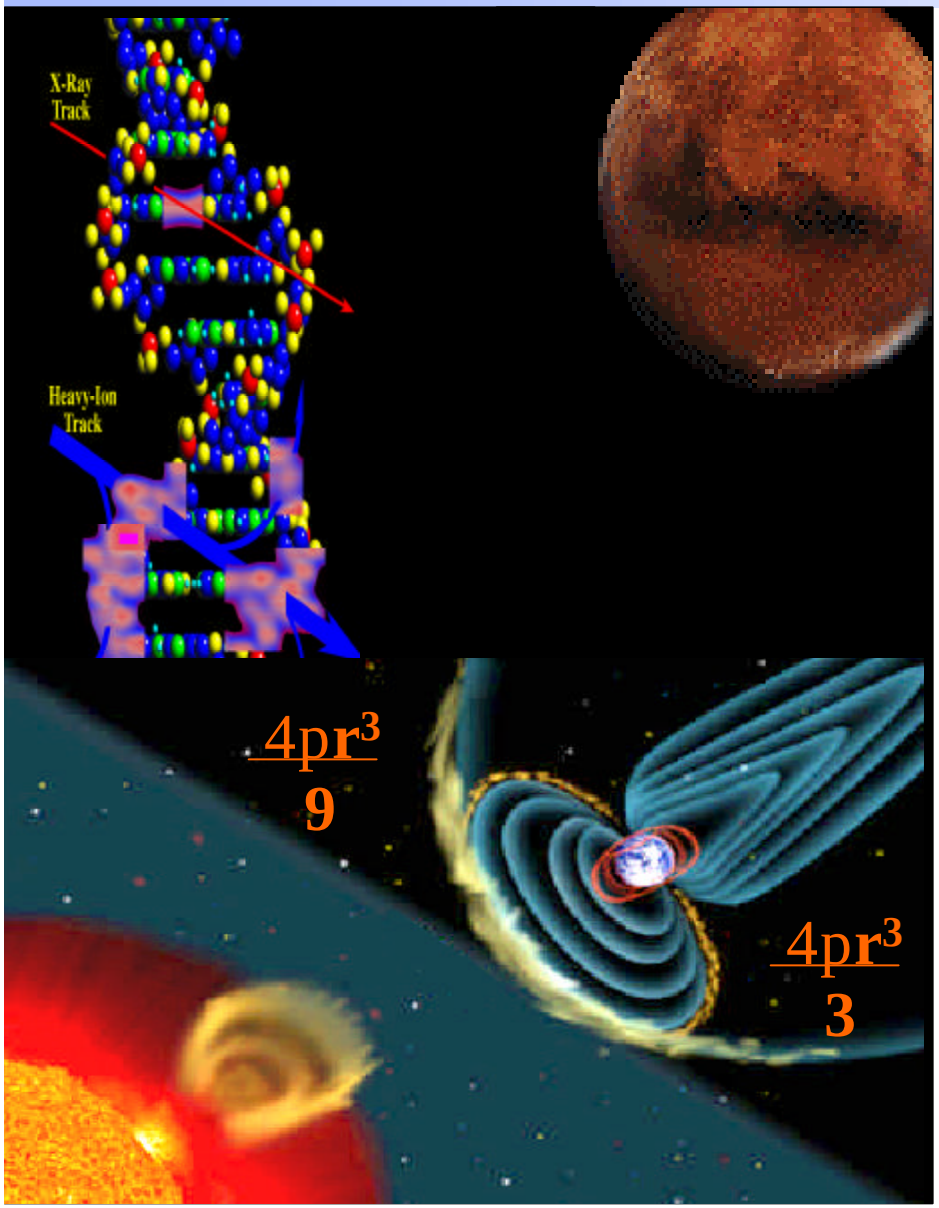
Human System Environment



- Variable gravity
- Radiation
  - Solar (variable flux)
  - Cosmic (background)
- Temperature extremes
- Pressure extremes
- New ecological systems
- Planetary materials and composition

Internal Environment

- Atmospheric composition
- Toxicology
- Crew living conditions
  - Work environment
  - Personal space
  - Recreation
- Habitat configuration (compatibility)

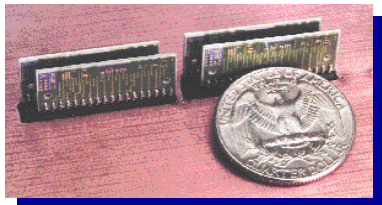
System configuration is intimately tied to internal environmental

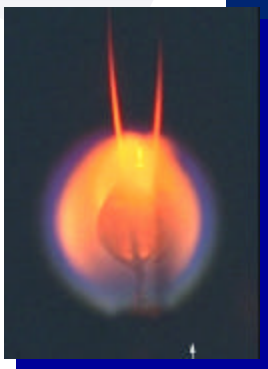
System Function

Human System Environment

The System should compliment human capabilities and minimize risk, while being compatible with the exploration

- Life support
- Environmental control
- Radiation shielding
- Medical capability





Underlying research

Fluids management

Materials research

Combustion science (fire suppression)

Gravitational biology (biomass production)

Biological interface

System Design

Human System Environment

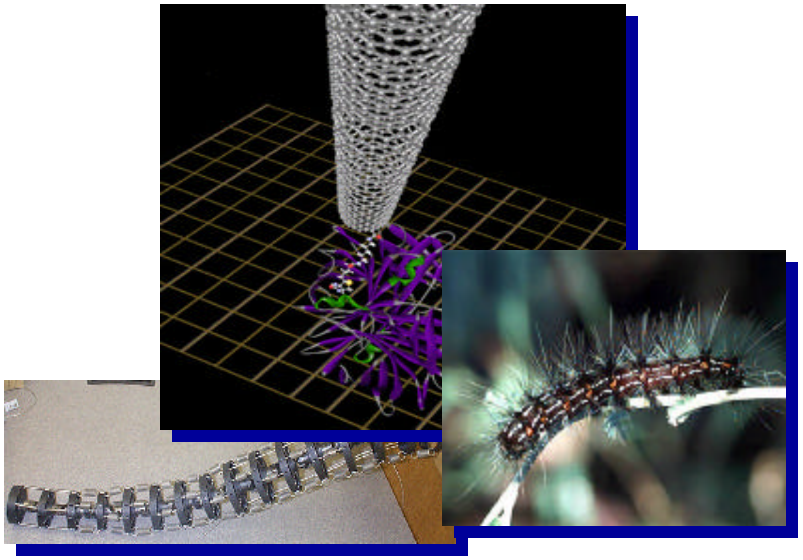
System design needs to accommodate constraints on available power; mass; and crew size, expertise, and availability.

- Miniaturization
- Autonomy
- Redundancy

Biologically-inspired technologies

- Accessibility
- Ease-of-use
- Emergency procedures

Human factors



System Performance

Human System Environment

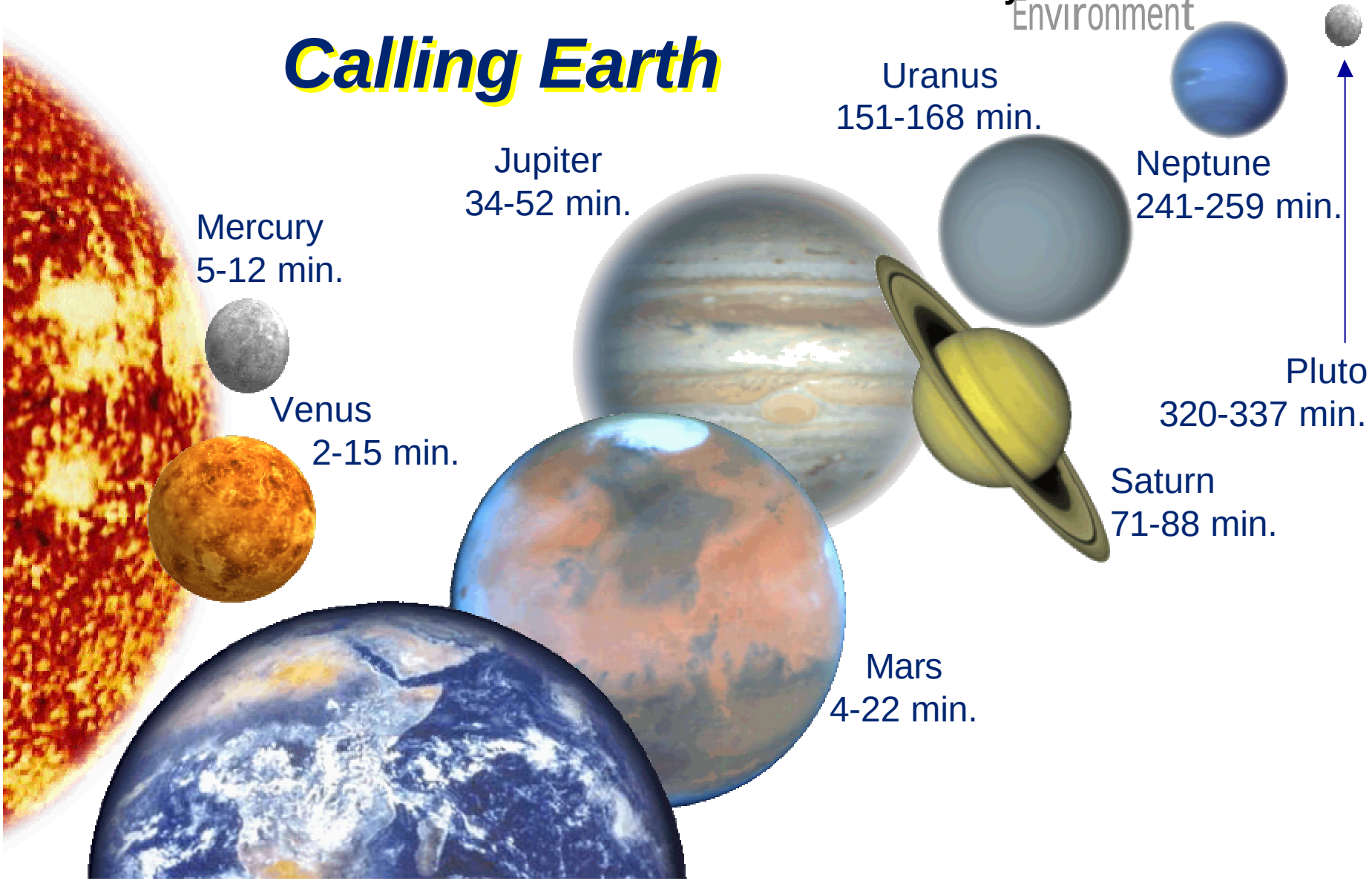
A system is effective only once it is successfully

- Standard operating procedures
  - Vehicle/habitat operations
  - Maintenance procedures
  - Health risk minimization
  - Work/rest cycles
- System performance parameters/limits

System Constraint
Time/Distance

Human System Environment

Calling Earth



Crew Selection

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Human System Environment

Medical considerations and requirements will vary with mission duration and complexity.

- Health risk factors
- Skills
- Psychological suitability
- Crew compatibility

Crew Training

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Human System Environment

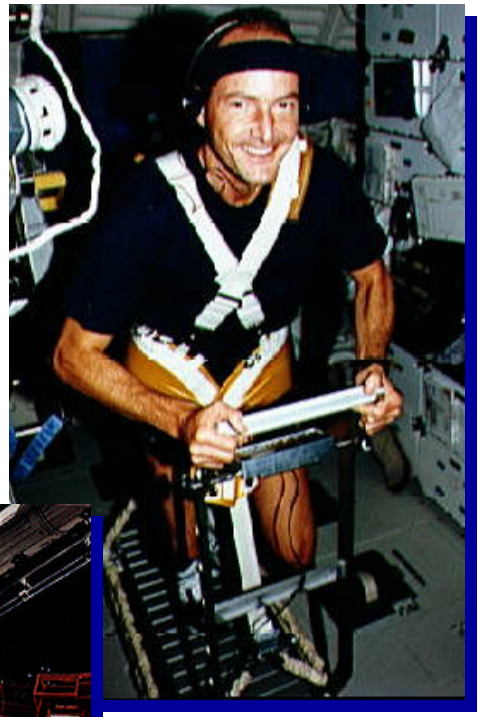
- Survival
- Mission-specific
  - Operations
  - Research procedures
- Medical care
  - Routine assessments
  - Emergency interventions

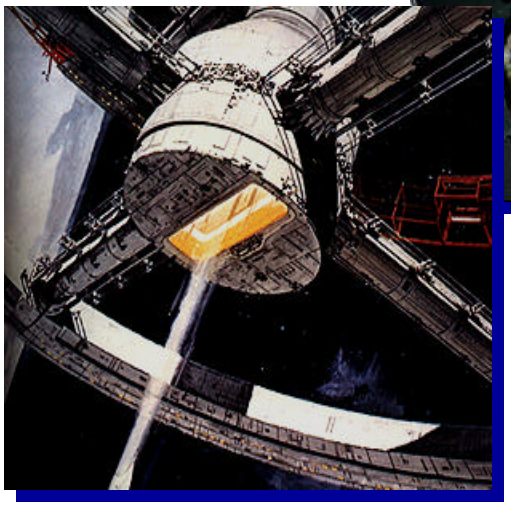
Crews will undergo continuous, rigorous training in order to maintain proficiency.

Crew Protection

System configuration provides environmental protection and all necessary tools and capability for crew well-being.

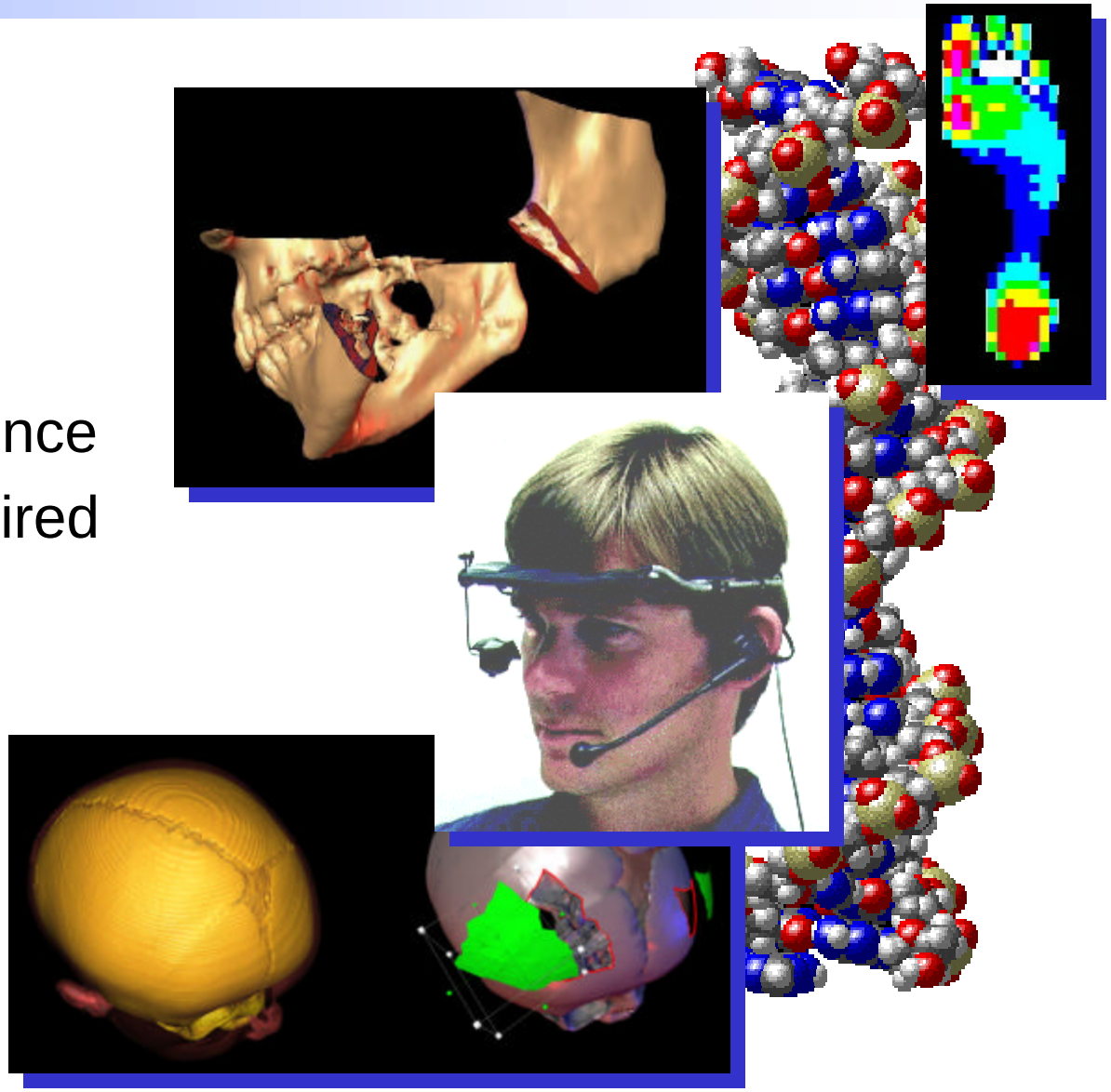
- Countermeasures
  - Traditional
  - Non-traditional
- Psychosocial support





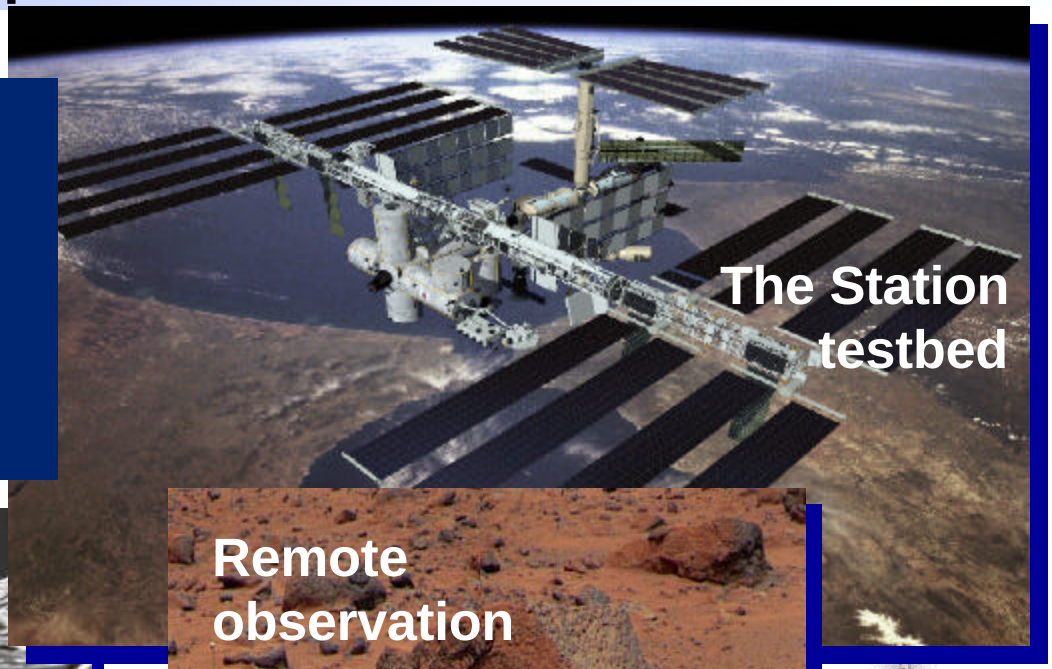
Cross-cutting Technology Needs

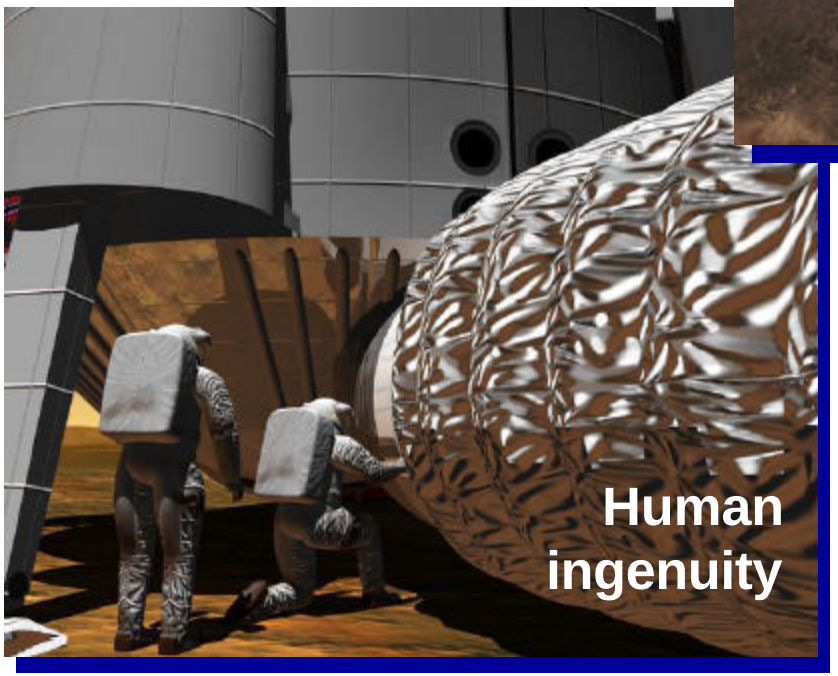
- Portability
- Miniaturization
- Virtual reality
- Artificial intelligence
- Biologically-inspired technologies



Complementary Roles in Exploration

Robotic missions complement human capabilities in an integrated exploration program.





Station as a Testbed

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Station is an integrated test platform for exploration technologies and operations.

Human System Environment